

System for collection, transportation and delivery of drill cuttings

Publication number: GB2369135
Publication date: 2002-05-22
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Classification:
- International: E21B21/01; E21B21/00; (IPC1-7): E21B21/01
- European: E21B21/01
Application number: GB20000027916 20001115
Priority number(s): GB20000027916 20001115

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Abstract of GB2369135

A method for handling drill cuttings with a fluid content up to 40% by volume comprises transferring the cuttings to a storage container 7 at the drilling site 1, removing the drill cuttings from the storage container 7 using an excavator 33 attached to a conveyor 34 and transferring the drill cuttings to a transportation container 9 or 10 on or within a ship 8. The drill cuttings are delivered to a treatment site, where they are removed from the transportation container 9 or 10, and transferred to a storage container at the treatment site.

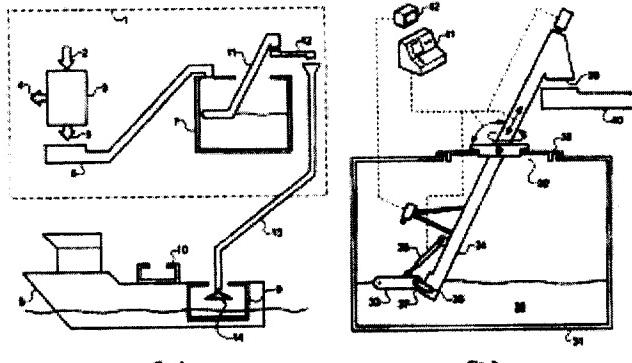


Fig. 1

Fig. 2

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(12) UK Patent Application GB (19) 2 369 135 (13) A

(43) Date of A Publication 22.05.2002

(21) Application No 0027916.6

(51) INT CL⁷
E21B 21/01

(22) Date of Filing 15.11.2000

(52) UK CL (Edition T)
E1F FGM

(71) Applicant(s)

(56) Documents Cited
WO 99/22113 A1 WO 00/45028 A1
WO 00/37803 A1

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(58) Field of Search
UK CL (Edition S) E1F FGM
INT CL⁷ E21B 21/00 21/01 21/06
Online: WPI, EPDOC, JAPIO

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(54) Abstract Title

System for collection, transportation and delivery of drill cuttings

(57) A method for handling drill cuttings with a fluid content up to 40% by volume comprises transferring the cuttings to a storage container 7 at the drilling site 1, removing the drill cuttings from the storage container 7 using an excavator 33 attached to a conveyor 34 and transferring the drill cuttings to a transportation container 9 or 10 on or within a ship 8. The drill cuttings are delivered to a treatment site, where they are removed from the transportation container 9 or 10, and transferred to a storage container at the treatment site.

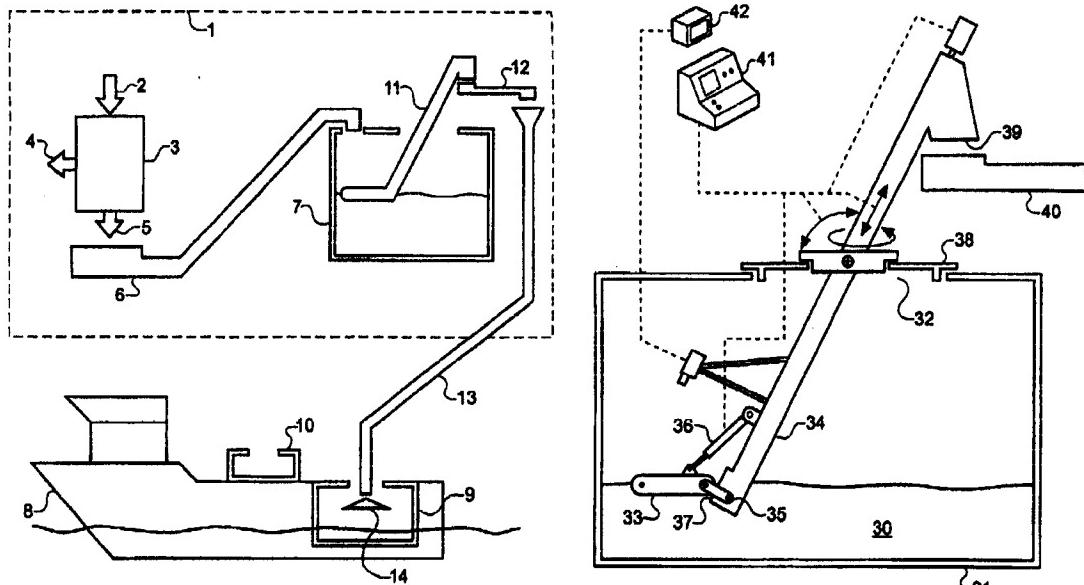


Fig. 1

Fig. 3

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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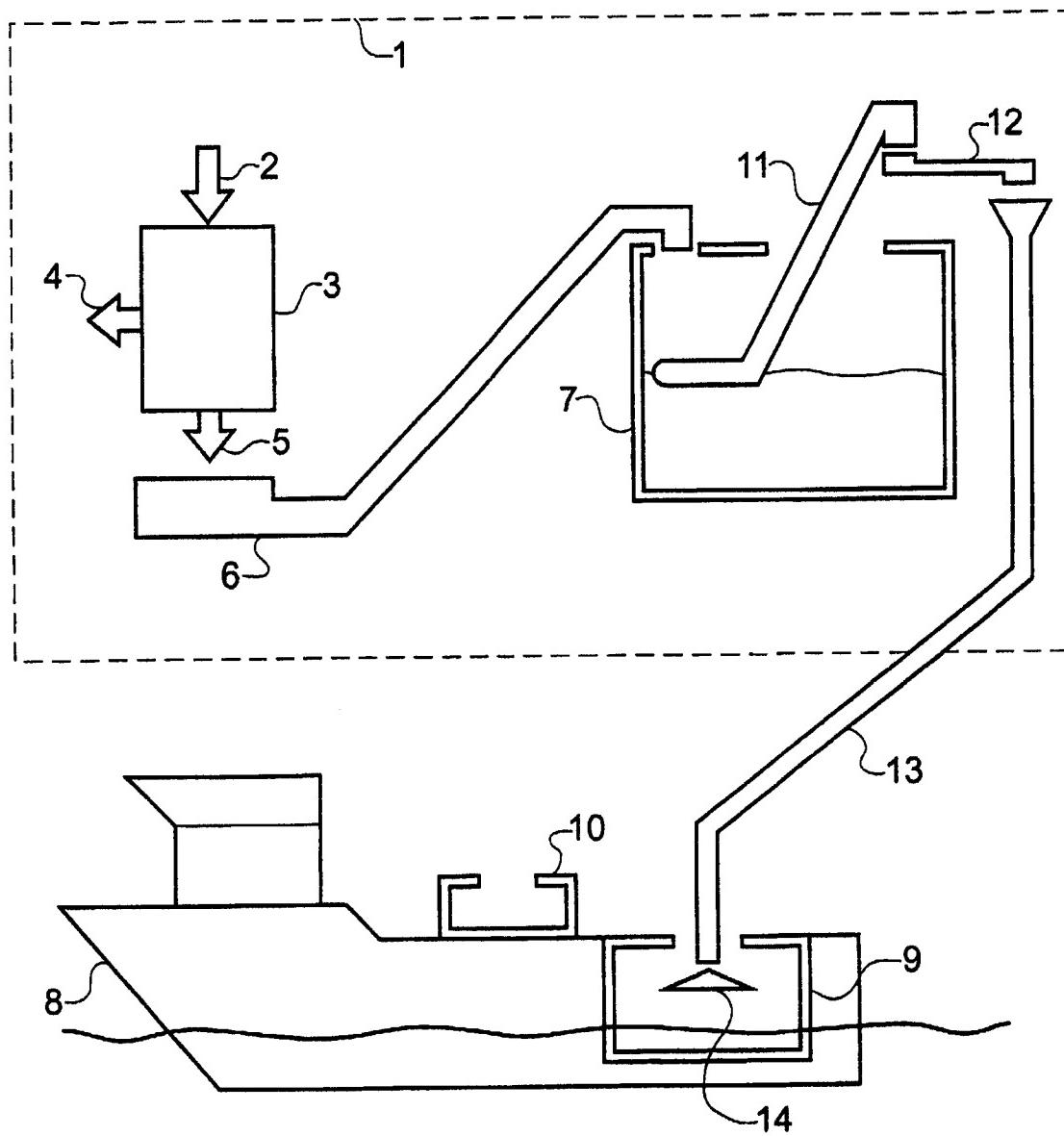


Fig. 1

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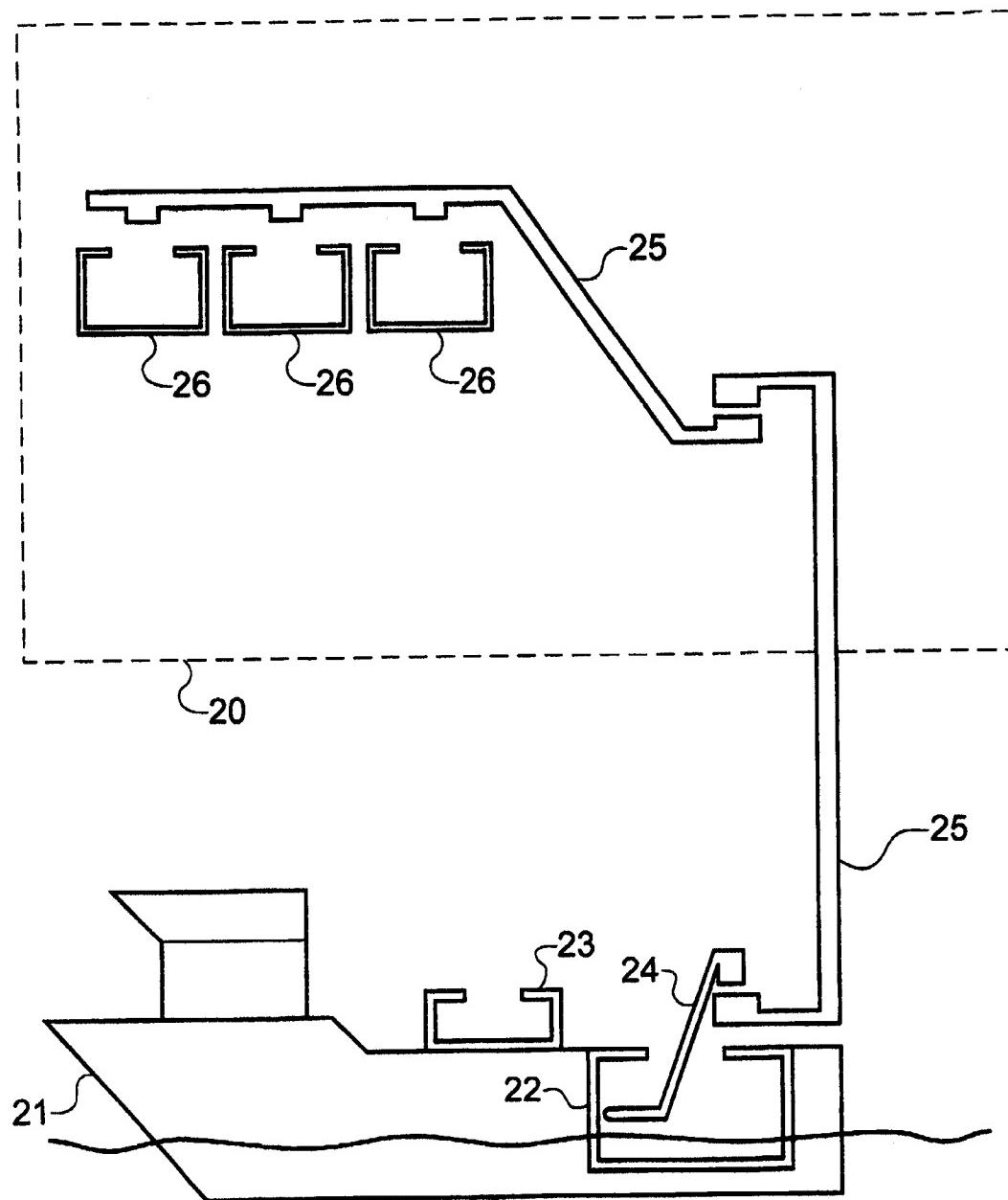


Fig. 2

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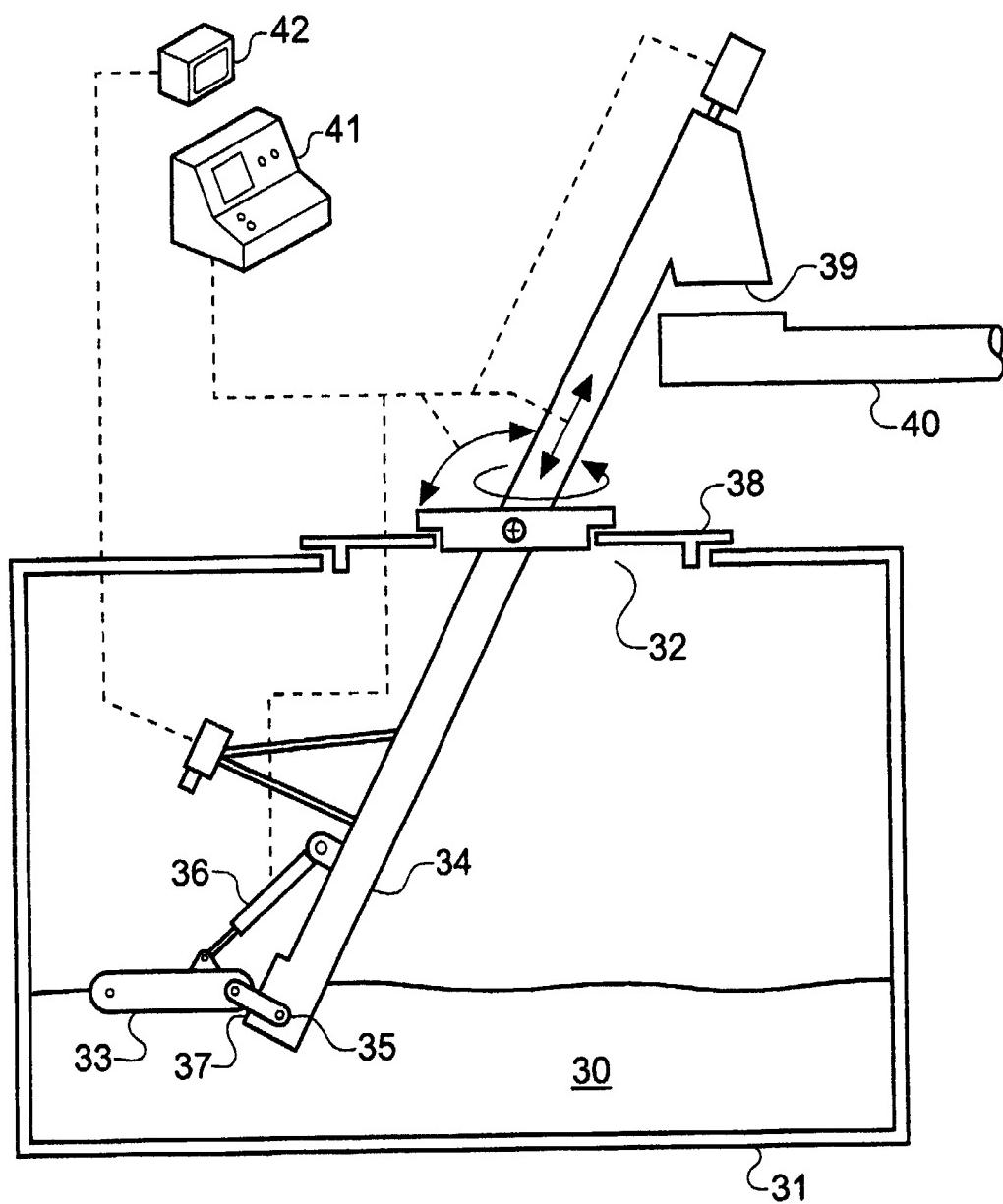


Fig. 3

1 SYSTEM FOR THE COLLECTION, TRANSPORTATION AND DELIVERY OF2 DRILL CUTTINGS

3

4 The process of drilling boreholes for the production of oil or gas from a subterranean
5 reservoir generates waste material in the form of rock chippings, known as drill
6 cuttings. During the drilling process such drill cuttings may be contaminated with
7 hydrocarbons and chemicals which are considered to adversely affect the
8 environment. The contaminated drill cuttings form a glutinous mass, particularly if
9 the rock particles include hydroscopic shales which absorb some of the contaminating
10 liquids to form a very soft and sticky outer layer. One method of safely disposing of
11 the drill cuttings is to transport them to a treatment plant where the rock chippings are
12 separated from the contaminants. Typically such treatment plants will also endeavour
13 to recover as much of the hydrocarbons as possible for further use.

14

15 The usual method of transporting the contaminated drill cuttings between the drilling
16 site and the treatment plant is by placing the material in special metal containers, each
17 typically holding approximately 5.0 tonnes of material. This system has a number of
18 disadvantages: firstly each container weighs nearly as much as the contents and the
19 special design for containment of the material is expensive. Secondly a typical well
20 might produce enough drill cuttings to fill about 100 containers, giving a problem of
21 storage and taking much time to load onto transport. Thirdly the standard method of
22 emptying such containers is by tipping them upside-down, which is an operation
23 involving some risk to personnel.

24

1 A second method of transporting the contaminated drill cuttings between the drilling
2 site and the treatment plant is by transferring the material into a few larger containers
3 which are too heavy to lift by offshore crane and may be located, by way of example,
4 on or beneath the deck of a marine vessel. It has been observed that during
5 transportation the liquid phase, being mainly hydrocarbons and water, becomes
6 separated from the solid phase as a result of vibration, and the solid phase becomes
7 compacted at the bottom of the container.

8

9 Existing operators have sought to transfer the material from the large containers to the
10 treatment plant, which may be a distance of 100 metres or more, by means of a pump.
11 The material can only be pumped if a high proportion of liquid is present and
12 homogenised with the drill cuttings, as noted in Patent Application Nos. GB 2339443,
13 GB 2330600, WO 0037803, and WO 0045028. In spite of claims to the contrary,
14 observations and extensive testing by the Applicant has found that typically 50-65%
15 liquid is required to permit the material to be pumped. Such liquid is to the detriment
16 of the subsequent drill cuttings cleaning process. Furthermore the process of
17 homogenisation has proved to be very difficult once separation and compaction has
18 occurred, even when using a pump with a shaft mounted disintegrator tool as
19 described in Patent Application No. WO 0037803. Typically this difficulty is made
20 worse by the limited size of the openings which provide access into the transportation
21 containers. It has also been observed that the processes of homogenisation by
22 agitation, and of the act of pumping, causes the material to increase in viscosity
23 through a reaction between the rock particles and the contaminating liquids.

24

1 Those skilled in the art of pumping will recognise that such material does not behave
2 as a Newtonian fluid and therefore is not suited to this method of transfer.

3

4 When the contaminated drill cuttings are separated from the drilling fluids by the
5 solids control equipment as part of the drilling process they are relatively dry, but
6 fluid is then added to the material in order to facilitate transfer to the transportation
7 containers.

8

9 An object of the present invention is to provide a means by which contaminated drill
10 cuttings can be transferred from the solids control equipment at the drilling site to the
11 treatment plant with minimum handling by, and risk to, personnel involved in the
12 process, and with the minimum liquid content to ensure optimum performance of the
13 treatment plant.

14

15 In accordance with a first aspect of the present invention, a system for the collection
16 of drill cuttings at the drilling site comprises a means for transferring the
17 contaminated drill cuttings to storage or transportation containers at the drilling site; a
18 means of recovering contaminated drill cuttings from the storage container; and a
19 means for transferring the contaminated drill cuttings to the transportation container
20 on or within a transportation means.

21

22 In accordance with a second aspect of the present invention, a system for the delivery
23 of drill cuttings to the treatment site comprises a means for recovering compacted
24 contaminated drill cuttings from the transportation container; and a means for
25 transferring the contaminated drill cuttings to the treatment site storage containers.

1

2 In accordance with a third aspect of the present invention, a system for the recovery of
3 contaminated drill cuttings from transportation and storage containers comprises
4 means for excavating drill cuttings without pumping; means to move the excavation
5 device in three dimensions within the container; and a means to remove the excavated
6 material from the container

7

8 The excavating means may, for example, be an air transfer system, a screw conveyor
9 or a vacuum transfer system. However, most preferably the excavating means is a
10 mechanical excavator, so that drill cuttings having a fluid content of up to 40% by
11 volume, which are difficult to pump, can be excavated without difficulty and without
12 the need for separate mechanical agitation.

13

14 It will be appreciated that at even lower fluid content or when the solids have
15 separated from the fluid component, the drill cuttings cannot be pumped at all.
16 However, lower fluid content makes the cuttings easier and cheaper to process.
17 Therefore preferably, the drill cuttings have a fluid content of up to 30% by volume.

18

19 The drill cuttings are most preferably initially handled in the substantially dry state in
20 which they are ejected from the solids control equipment which removes the drilling
21 fluid from the drill cuttings, so that the drilling fluid can be returned to the bore hole.

22

23 Preferably the system is controlled by personnel located outside the transportation
24 container.

25

1 Preferably a means is included to communicate the location and orientation of the
2 excavation device to operating personnel located outside the transportation container.

3

4 Preferably a means is included to remove any separate liquid phase from the surface
5 of the compacted contaminated drill cuttings within the transportation container prior
6 to commencement of excavation of the solid phase.

7

8 An embodiment of the present invention will now be described by way of example
9 only with reference to the accompanying drawings, in which:-

10

11 FIGURE 1 is a block diagram illustrating a collection system in accordance with a
12 first aspect of the present invention.

13

14 FIGURE 2 is a block diagram illustrating a delivery system in accordance with a
15 second aspect of the present invention.

16

17 FIGURE 3 is an illustration of a container emptying system in accordance with a third
18 aspect of the present invention.

19

20 DESCRIPTION OF COLLECTION SYSTEM (figure 1)

21 Enclosure (1) delineates the part of the system which is located at the drilling site.
22 The drilling fluid (2) carries the contaminated drill cuttings from the wellbore to the
23 solids control equipment (3), which separates the reusable drilling fluid (4) from the
24 contaminated drill cuttings (5). The contaminated drill cuttings are delivered into a
25 conveyor (6), which may, by way of example, be a tube type chain conveyor. The

1 conveyor (6) delivers the contaminated drill cuttings into storage containers. The
2 storage containers may be portable (not shown) for transportation complete with
3 contents to the contaminated drill cuttings treatment plant site, or permanently
4 installed at the drilling site (7). When it is desired to transport the contaminated drill
5 cuttings from the permanent storage containers (7) to the treatment plant site a
6 transportation means, for example a supply boat (8) will attend the drilling site (1).
7 The transportation means (8) carries transportation containers which may be fitted
8 below the deck (9) or on the deck (10) or in any appropriate manner according to the
9 transport means. The storage container emptying system (11) removes the
10 contaminated drill cuttings from the permanent storage containers (7) and delivers the
11 material to one or a series of loading conveyors (12), which may, by way of example,
12 be a tube type chain conveyor. The loading conveyor (12) transports the
13 contaminated drill cuttings into a loading means (13), which may be an open conduit,
14 screw conveyor, or other suitable means. The contaminated drill cuttings pass along
15 the loading means into the transportation container. A dispersal means (14) may be
16 used to ensure even distribution of contaminated drill cuttings within the
17 transportation container.

18

19 DESCRIPTION OF DELIVERY SYSTEM (Figure 2)

20 Enclosure (20) delineates the part of the system which is located at or adjacent to the
21 contaminated drill cuttings treatment plant. A transportation means, for example a
22 supply boat (21) will attend the treatment plant site (20). The transportation means
23 (21) carries transportation containers which may be fitted below the deck (22) or on
24 the deck (23) or in any appropriate manner according to the transport means. The
25 transportation container emptying system (24) removes the contaminated drill cuttings

1 from the transportation containers (22) or (23) and delivers the material to one or
2 more conveyor(s) (25), which may, by way of example, be tube type chain conveyors.
3 The conveyor(s) (25) transport the contaminated drill cuttings into one or more
4 storage containers (26) at the treatment plant ready for processing.

5

6 **DESCRIPTION OF CONTAINER EMPTYING SYSTEM (Figure 3)**

7 The contaminated drill cuttings (30) are located in the container (31) which may be a
8 storage container or a transportation container. Access to the container (31) is by
9 means of an opening (32), which is shown, by way of example, in the top of the
10 container. An excavator (33) is attached to a conveyor (34) by means of an
11 articulated joint (35). By way of example, the excavator (33) may be a conveyor
12 excavator comprising a series of dredging/digging buckets or teeth equidistantly
13 spaced around the outside of an endless chain or belt which is driven around a support
14 which may comprise sprockets or rollers. The buckets or teeth scoop or scrape the
15 drill cuttings to the conveyor (34) which is, for example, a tube type chain conveyor.
16 The position of the excavator (33) relative to the conveyor (34) may be adjusted, for
17 example by means of a hydraulic cylinder (36) which rotates the excavator (33) about
18 the articulated joint (35). The excavator (33) moves the material to an inlet opening
19 (37) in the conveyor (34). The conveyor (34) is carried on mounting frame (38)
20 which may be fitted into the opening (32) or on the upper outside surface of the
21 container. The conveyor (34) can rotate within the mounting frame (38) and can be
22 raised and lowered independently of the mounting frame (38). The contaminated drill
23 cuttings are discharged from the conveyor (34) through an outlet (39) which might, by
24 way of example, be connected to another conveyor (40) for transportation to the next
25 part of the transportation system. A control system (41) provides an operator with

1 control over the speed and position of the excavator and the conveyor. Monitoring
2 means is provided to inform the operator of the position of the excavator in the
3 container which may, by way of example, be a closed circuit TV system (42) or one
4 or more sensors which sense the position of the excavator (33) in the container (31).

5

1 CLAIMS

2 1. A method for the handling of drill cuttings at a drilling site, the drill cuttings
3 having a fluid content of up to 40% by volume, the method comprising the steps of:
4 transferring the drill cuttings to a storage container at the drilling site;
5 removing the drill cuttings from the storage container;
6 transferring the drill cuttings to a transportation container on or within a
7 transportation means.

8

9 2. A method for the delivery of drill cuttings having a fluid content of up to 40%
10 by volume to a treatment site comprising removing the drill cuttings from a
11 transportation container; and transferring the drill cuttings to a storage container at the
12 treatment site.

13

14 3. Apparatus for the removal of drill cuttings from a container comprising
15 mechanical excavator means for excavating drill cuttings within the container; means
16 for moving the excavating means within the container; and means for removing the
17 excavated material from the container.

18

19 4. Apparatus as claimed in claim 3, in which control means is provided
20 externally of the container, for controlling the excavating means.

21

22 5. Apparatus as claimed in claim 4, further comprising means for communicating
23 the location and orientation of the excavation device to the said external control
24 means.

25

1 6. Apparatus as claimed in any one of claims 3 to 5, in which means is provided
2 to remove any separate liquid phase from the surface of the compacted contaminated
3 drill cuttings within the container prior to commencement of excavation of the solid
4 phase.

5

6 7. Apparatus as claimed in any one of claims 3 to 6, in which the excavating
7 means comprises a mechanical excavator having a plurality of buckets or teeth
8 supported on an endless drive member.

9

10 8. A method substantially as described herein, with reference to the
11 accompanying drawings.

12

13 9. Apparatus substantially as described herein, with reference to and as shown in
14 the accompanying drawings.

15

16

17



Application No: GB 0027916.6
Claims searched: 1

Examiner: Eleanor Wade
Date of search: 21 February 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.S): E1F FGM
Int Cl (Ed.7): E21B
Other: Online: EPODOC, WPI, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	WO 0045028 (Halliburton Energy Services) whole doc.	1
X	WO 0037803 (DeJager V) Page 8 lines 14-22	1
X	WO 9922113 (Bailey) see Fig. 1 and page 4, second paragraph	1

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|---|---|---|--|
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